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APPLICATION FOR LETTERS PATENT

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**RADIO FREQUENCY IDENTIFICATION DEVICES,
REMOTE COMMUNICATION DEVICES,
IDENTIFICATION SYSTEMS, COMMUNICATION
METHODS, AND IDENTIFICATION METHODS**

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1 RADIO FREQUENCY IDENTIFICATION DEVICES, REMOTE
2 COMMUNICATION DEVICES, IDENTIFICATION SYSTEMS,
3 COMMUNICATION METHODS, AND IDENTIFICATION METHODS

4 TECHNICAL FIELD

5 This invention relates to radio frequency identification devices,
6 remote communication devices, identification systems, communication
7 methods, and identification methods.

8
9 BACKGROUND OF THE INVENTION

10 Wireless communication systems including electronic identification
11 devices, such as radio frequency identification devices (RFIDs), are
12 known in the art. Such devices are typically used for inventory
13 tracking. As large numbers of objects are moved in inventory, product
14 manufacturing, and merchandising operations, there is a continuous
15 challenge to accurately monitor the location and flow of objects.
16 Additionally, there is a continuing goal to determine the location of
17 objects in an inexpensive and streamlined manner. One way of tracking
18 objects is with an electronic identification system.

19 One presently available electronic identification system utilizes a
20 magnetic coupling system. Typically, the devices are entirely passive
21 (have no power supply), which results in a small and portable package.
22 However, such identification systems are only capable of operation over
23 a relatively short range, limited by the size of a magnetic field used to
24 supply power to the devices and to communicate with the devices.

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1 Another type of wireless communication system is an active
2 wireless electronic identification system. Attention is directed towards
3 commonly assigned U.S. Patent Application Serial No. 08/705,043, filed
4 August 29, 1996, incorporated herein by reference, and which describes
5 such active systems in detail.

6 These systems include integrated circuit devices which include an
7 active transponder and are intended to be affixed to an object to be
8 monitored. The devices are capable of receiving and processing
9 instructions transmitted by an interrogator. A device receives the
10 instruction, if within range, then processes the instruction and transmits
11 a response, if appropriate. The interrogation signal and the responsive
12 signal are typically radio-frequency (RF) signals produced by an RF
13 transmitter circuit. Because active devices have their own power
14 sources, such do not need to be in close proximity to an interrogator
15 or reader to receive power via magnetic coupling. Therefore, active
16 transponder devices tend to be more suitable for applications requiring
17 tracking of a tagged device that may not be in close proximity to an
18 interrogator. For example, active transponder devices tend to be more
19 suitable for inventory control or tracking.

20 It may be desired to identify one or more particular remote
21 communication devices within the plurality of remote communication
22 devices of the wireless communication system. For example, it may be
23 desired to identify the location of a particular package in the field.
24 An exemplary use is to assist with the quick identification of a desired

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1 package within numerous objects in inventory. Thus, there exists a
2 need to provide an improved identification system and identification
3 method of the remote communication devices.

4 5 SUMMARY OF THE INVENTION

6 The present invention provides radio frequency identification
7 devices, remote communication devices, identification systems,
8 communication methods, and identification methods.

9 A remote communication device including a radio frequency
10 identification device according to one aspect of the invention includes
11 a substrate and communication circuitry coupled with the substrate. The
12 communication circuitry is configured to receive a wireless signal
13 including an identifier, to process the identifier of the wireless signal
14 and to output a control signal responsive to the processing of the
15 identifier. Indication circuitry is coupled with the communication
16 circuitry and configured to receive the control signal and to indicate
17 presence of the remote communication device responsive to the control
18 signal.

19 The indication circuitry emits a human perceptible signal, such as
20 a visible signal, in but one configuration to indicate presence of the
21 desired remote communication device. Devices of the present invention
22 can be utilized in exemplary applications to assist with the identification
23 of one or more desired remote communication devices. Also, such can
24 be utilized to identify one or more desired objects associated with the

1 identified remote communication devices in one exemplary application.
2 Other aspects are provided in the present invention.
3

4 BRIEF DESCRIPTION OF THE DRAWINGS

5 Preferred embodiments of the invention are described below with
6 reference to the following accompanying drawings.

7 Fig. 1 is an illustrative diagram of an exemplary wireless
8 communication system.

9 Fig. 2 is a diagrammatic representation of an exemplary forward
10 link wireless signal outputted from an interrogator of the wireless
11 communication system shown in Fig. 1.

12 Fig. 3 is an isometric view of an exemplary remote communication
13 device of the wireless communication system shown in Fig. 1.

14 Fig. 4 is a functional block diagram of internal circuitry according
15 to one configuration of the remote communication device.

16 Fig. 5 is an illustrative representation of exemplary indication
17 circuitry of the remote communication device of Fig. 4.

18 Fig. 6 is a graphical illustration representing exemplary remote
19 communication device operations.

20 Fig. 7 is a graphical illustration showing further details of the
21 illustration of Fig. 6.

22 Fig. 8 is an illustrative representation of another configuration of
23 indication circuitry of the remote communication device.
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1 DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

2 This disclosure of the invention is submitted in furtherance of the
3 constitutional purposes of the U.S. Patent Laws "to promote the
4 progress of science and useful arts" (Article 1, Section 8).

5 Referring to Fig. 1, a wireless communication system 10 is
6 illustrated in accordance with one embodiment of the invention.
7 Wireless communication system 10 includes an interrogator 12 and at
8 least one remote communication device 14. Typically, numerous remote
9 communication devices 14 are provided within wireless communication
10 system 10 although only two such remote communication devices 14 are
11 illustrated in Fig. 1. The particular number of remote communication
12 devices 14 which are in communication with interrogator 12 may change
13 over time. During exemplary object monitoring operations, more or less
14 remote communication devices 14 can be within a communication range
15 of wireless communication system 10 as objects or packages are moved
16 about.

17 A communication range 11 of interrogator 12 is shown in Fig. 1.
18 Interrogator 12 communicates with remote communication devices 14
19 located within communication range 11. Typically, there is no
20 communication between multiple remote communication devices 14.
21 Instead, remote communication devices 14 respectively communicate with
22 interrogator 12. As previously mentioned, multiple remote
23 communication devices 14 are typically used in the same field of
24 interrogator 12 (i.e., within communications range 11 of interrogator 12).

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1 It may be beneficial to determine communication range 11 of
2 interrogator 12 in a given application. As described below, one aspect
3 of the disclosure provides a remote communication device 14 having
4 indication circuitry (one configuration is shown in Fig. 3) configured to
5 assist with the determination of communication range 11 during testing
6 operations. Such a remote configuration device 14 can comprise a
7 device utilized for normal communication or testing operations, or
8 alternatively, for testing operations only.

9 During testing operations, remote communication device 14 having
10 the indication circuitry of Fig. 3 can be moved throughout an area
11 larger than and including communication range 11 to assist with the
12 determination of communication range 11. Interrogator 12 can be
13 utilized to output plural forward link wireless signals 22 during testing
14 operations. Remote communication device 14 operates to output a
15 human perceptible signal (e.g., human visible light) as described below
16 when it is present within communication range 11 and receiving forward
17 link wireless signals 22. Such human perceptible signals can be used
18 to assist with determining communication range 11 of interrogator 12 by
19 noting where such human perceptible signals are generated as remote
20 communication device 14 is moved.

21 In addition, remote communication device 14 can be utilized to
22 verify correct installation and operation of 10 wireless communication
23 system. Remote communication device 14 indicates proper operation
24

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1 and installation of interrogator 12 responsive to receiving forward link
2 wireless signals 22.

3 In the described embodiment, wireless communication system 10
4 is configured as an electronic identification system. Other configurations
5 of wireless communication system 10 are possible. Remote
6 communication devices 14 can individually be associated with respective
7 objects 16, such as packages in inventory. Wireless communication
8 system 10 can also be used in other applications including other
9 identification applications.

10 Remote communication devices 14 individually comprise a wireless
11 identification device in the described arrangement. Other configurations
12 of remote communication devices 14 are possible. An exemplary
13 wireless identification device is a radio frequency identification
14 device (RFID). In the depicted configuration, remote communication
15 devices 14 individually include an antenna 18 for wireless or radio
16 frequency transmission by the respective remote communication
17 device 14. Remote communication devices 14 further individually include
18 an antenna 20 for wireless or radio frequency reception by the
19 respective remote communication device 14. In one embodiment, the
20 antennas 18, 20 are microstrip antennas.

21 Individual remote communication devices 14 transmit and receive
22 radio frequency communications to and from interrogator 12. An
23 exemplary interrogator is described in commonly assigned U.S. Patent
24 Application Serial No. 08/907,689, filed August 8, 1997 and incorporated

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herein by reference. Preferably, interrogator 12 includes an antenna 13 as well as dedicated transmitting and receiving circuitry. In one embodiment, such circuitry is complementary to that implemented within individual remote communication devices 14.

Radio frequency identification has emerged as a viable system for tagging or labeling small to large quantities of objects 16. In the described configuration, interrogator 12 and remote communication devices 14 communicate via an electromagnetic link, such as via an RF link (e.g., at microwave frequencies, in one embodiment), so all transmissions by interrogator 12 are heard simultaneously by all remote communication devices 14 within communication range 11.

Interrogator 12 transmits forward link wireless signals 22 individually comprising an interrogation signal or command via antenna 13. Referring to Fig. 2, an exemplary forward link wireless signal 22 is shown. The depicted forward link wireless signal 22 includes a preamble 23, barker code 25, tag identifier (ID) 26, command 27, data 28 and check sum 29.

Tag identifier 26 can comprise an identifier to identify one or more of remote communication devices 14 in some applications. For example, tag identifier 26 can identify one, more than one, or all of remote communication devices 14. As described below, typically only the remote communication devices 14 identified within tag identifier 26 process the respective command 27 and data 28.

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Referring again to Fig. 1, remote communication devices 14 within the appropriate communication range 11 individually receive the incoming interrogation forward link wireless signal 22 via respective antennas 20. Upon receiving wireless signal 22, individual ones of remote communication devices 14 can respond by generating and transmitting a responsive signal or return link communication signal 24 via respective antenna 18. The responsive signal 24 typically includes information that uniquely identifies, or labels the particular remote communication device 14 that is transmitting. Such may operate to identify a respective object 16 with which the responding remote communication device 14 is associated. Exemplary objects 16 include packages in inventory, people, automobiles, animals, etc.

Referring to Fig. 3, remote communication device 14 can be included in any appropriate packaging or housing 30. Various methods of manufacturing housings are described in commonly assigned U.S. Patent Application Serial No. 08/800,037, filed February 13, 1997, and incorporated herein by reference. An exemplary housing 30 includes an ultrasonically welded plastic injection molded case. Housing 30 is provided about a substrate 31 and at least some of the circuitry of remote communication device 14. Housing 30 can be configured as a case about substrate 31 to enclose most if not all of the internal components of remote communication device 14. More specifically, circuitry of remote communication device 14 is provided upon substrate 31 in one embodiment. An exemplary substrate 31 is FR4

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1 board.. Circuit components of remote communication device 14 may be
2 attached to substrate 31 using pick-and-place processing techniques.

3 Fig. 3 shows but one embodiment of remote communication
4 device 14 in the form of a card or badge including housing 30 of
5 plastic or other suitable material. In one embodiment, a face of
6 housing 30 has visual identification features such as graphics, text,
7 information found on identification or credit cards, etc. (not shown).
8 Housing 30 can also be formed as a miniature housing encasing the
9 internal circuitry and power supply 16 to define a tag which can be
10 supported by object 16 (e.g., hung from an object, affixed to an
11 object, etc.). Other forms of housings 30 are employed in alternative
12 embodiments.

13 In the illustrated embodiment, remote communication device 14
14 includes communication circuitry 32, a power source 34 and indication
15 circuitry 36. Communication circuitry 32 is defined by a small outline
16 integrated circuit (SOIC) as described in the above-incorporated patent
17 application 08/705,043, filed August 29, 1996. Exemplary communication
18 circuitry 32 is available from Micron Communications Inc., 3176 S.
19 Denver Way, Boise, Idaho 83705 under the trademark Microstamp
20 Engine (TM) and having designations MSEM256X10SG,
21 MT59RC256R1FG-5. Other embodiments of communication circuitry 32
22 are possible. Power source 34 is connected to supply power to
23 communication circuitry 32 and indication circuitry 36.
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1 In one embodiment, power source 34 comprises one or more
2 batteries. Individual batteries can take any suitable form. Preferably,
3 the battery type will be selected depending on weight, size, and life
4 requirements for a particular application. In one embodiment, a
5 suitable battery is a thin profile button-type cell forming a small and
6 thin energy cell more commonly utilized in watches and small electronic
7 devices requiring a thin profile. A conventional button-type cell has a
8 pair of electrodes, an anode formed by one face and a cathode formed
9 by an opposite face. In an alternative embodiment, power source 34
10 comprises a series connected pair of button type cells. In alternative
11 embodiments, other types of suitable power source are employed.
12 Suitable batteries of power source 34 individually include a 3 Volt
13 battery having designation CR2016 available from Eveready Battery Co.
14 Two such batteries can be coupled in series for a 6 Volt output of
15 power source 34 in one embodiment.

16 In the described arrangement, communication circuitry 32 is
17 coupled with substrate 31 and is configured to at least one of receive
18 wireless signals and communicate wireless signals. Exemplary received
19 and communicated wireless signals comprise radio frequency signals as
20 previously described. In one embodiment, communication circuitry 32
21 comprises transponder circuitry configured to output the reply or return
22 link wireless identification signal responsive to the reception of a
23 forward link wireless interrogation signal generated within
24 interrogator 12.

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1 Indication circuitry 36 is coupled with substrate 31 and
2 communication circuitry 32. In the described embodiment, indication
3 circuitry 36 includes an indicator 38 to indicate operation of remote
4 communication device 14. Remote communication device 14 can be
5 configured such that indication circuitry 36 indicates at least one of
6 reception of wireless signals and generation of wireless signals.
7 Indication circuitry 36 may also be configured to indicate the outputting
8 of wireless signals from remote communication device 14.

9 Remote communication device 12 having indication circuitry 36 can
10 also be configured to provide additional indication operations in addition
11 to those described herein. Exemplary additional indication operations
12 of remote communication device 12 are described in a commonly
13 assigned U.S. Patent Application entitled "Radio Frequency Identification
14 Devices, Wireless Communication Systems, Communication Methods,
15 Methods of Forming a Radio Frequency Identification Device, Methods
16 of Testing Wireless Communication Operations, and Methods of
17 Determining a Communication Range", naming Mark T. Van Horn,
18 David K. Ovard and Scott T. Trosper as inventors, filed the same day
19 as the present application, having attorney docket number MI40-187, and
20 incorporated herein by reference, and in a commonly assigned U.S.
21 Patent Application entitled "Radio Frequency Identification Devices,
22 Remote Communication Devices, Wireless Communication Systems, and
23 Methods of Indicating Operation", naming Scott T. Trosper as inventor
24

1 filed the same day as the present application, having attorney docket
2 number MI40-218, and incorporated herein by reference.

3 Indication circuitry 36 includes indicator 38 configured to emit a
4 human perceptible signal to indicate operation of the remote
5 communication device 14 in accordance with a preferred configuration.
6 In the described embodiment, indicator 38 is configured to visually
7 indicate operation of remote communication device 14. In particular,
8 indicator 38 can include at least one light emitting device, such as a
9 light emitting diode (LED), to emit a signal visually perceptible to
10 humans. An exemplary LED has designation L20265-ND and is
11 available from Digi-Key Corp. Indication circuitry 36 can also include
12 other indicators 38 for indicating operation of remote communication
13 device 14. Another exemplary indicator 38 includes an audible device,
14 such as a buzzer. Indicator 38 can have other configurations.

15 Preferably, remote communication device 14 is configured such that
16 indicator 38 of indication circuitry 36 outwardly emits the human
17 perceptible signal or otherwise indicates operation outside of housing 30.
18 For example, indicator 38 may extend through housing 30 as shown and
19 is externally visible. In the depicted arrangement, housing 30 is
20 provided about substrate 31 and internal circuitry with indication
21 circuitry 36 at least partially outwardly exposed as illustrated.

22 Referring to Fig. 4, communication circuitry 32 of remote
23 communication device 14 implemented as a single die in accordance with
24 the described embodiment includes a transmitter 40, a receiver 42, a

1 memory 44, and a microprocessor 46. Microprocessor 46 is coupled to
2 transmitter 40, receiver 42, and memory 44 as described in U.S. Patent
3 Application Serial Number 08/705,043. In one configuration,
4 transmitter 40 is configured to reply using backscatter communications.

5 Forward link wireless signals 22 are received within antenna 20
6 and applied to receiver 42. The forward link wireless signals 22 can
7 be specific to individual remote communication devices 14, or intended
8 to apply to some or all remote communication devices 14 within
9 communication range 11.

10 Microprocessor 46 is configured to process the signals received by
11 receiver 42. Responsive to the content of a received forward link
12 wireless signal 22, microprocessor 46 can formulate return link wireless
13 signal 24 which is applied to transmitter 40. Transmitter 40 operates
14 to output return link wireless signals 24 using antenna 18. As
15 previously described, transmitter 40 may be configured for backscatter
16 communications. For example, antenna 18 can be configured as a
17 dipole antenna and transmitter 40 can selectively short halves of the
18 dipole antenna configuration to selectively reflect a continuous wave
19 signal generated by interrogator 12.

20 Referring to Fig. 5, operations of communication circuitry 32 and
21 indication circuitry 36 are described. As previously mentioned,
22 communication circuitry 32 can be implemented in a SOIC configuration.
23 The SOIC includes plural pin connections, some of which are illustrated
24 in Fig. 5. For example, a pin 4 is coupled with an internal current

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1 source (not shown) which is configured to output a current signal
2 corresponding to backscatter communications. The current signal
3 outputted from pin 4 corresponds to the control signal utilized to
4 control modulation of the continuous wave signal during backscatter
5 communications.

6 Plural pins 5, 6 of communication circuitry 32 can be coupled
7 with antenna 18. In one embodiment, pins 5, 6 can be coupled with
8 respective halves of the dipole antenna configuration to implement
9 backscatter communications. Internal of communication circuitry 32, a
10 switch (not shown) selectively shorts pins 5, 6 to implement the
11 appropriate backscatter modulation communications. A pin 13 of
12 communication circuitry 32 is a ground voltage reference pin.

13 In the depicted arrangement, pins 4, 13 are coupled with
14 indication circuitry 36. The depicted indication circuitry 36 includes
15 indicator 38, transistor 50, resistor 52 and capacitor 54 arranged as
16 illustrated. In an exemplary configuration, capacitor 54 is a 0.1 μ F
17 5mT capacitor having designation ZVN3306FCT-ND available from Digi-
18 Key Corp. and resistor 52 is a 620 Ohm 1/8th Watt 5mT resistor
19 having designation P620ETR-ND available from Digi-Key Corp.
20 Transistor 50 is a ZVN3306FCT-ND N-Channel MOSFET transistor
21 available from Digi-Key Corp.

22 During operations, remote communication device 14 including
23 indication circuitry 36 can be moved within an area including
24 communication range 11. Interrogator 12 can be provided in a mode

1 to continually transmit an identify command which prompts a return
2 message from all remote communication devices 14 within communication
3 range 11. In such a test mode, remote communication device 14 having
4 indication circuitry 36 configured as shown can assist with the
5 determination of communication range 11.

6 For example, following the receipt and processing by
7 microprocessor 46 of forward link wireless signal 22 having an
8 appropriate tag identifier 26 and identify command 27, remote
9 communication device 14 formulates a return link wireless signal.
10 Microprocessor 46 formulates the return link wireless signal and
11 transmitter 40 is configured to output the return link wireless signal.
12 Such return link wireless signals can be applied via pin 4 to indication
13 circuitry 36. During testing operations to determine communication
14 range 11, wireless communications via antenna 18 can remain enabled
15 or, alternatively, be disabled if return link communication signals are
16 undesired.

17 Transmitter 40 outputs a current signal via pin 4 to indication
18 circuitry 36 during a return link communication. Pin 4 can be coupled
19 with the gate (G) of transistor 50. Responsive to the gate receiving
20 current from pin 4, the drain (D) connection is coupled with the
21 source (S) connection of transistor 50. Such closes the circuitry within
22 indication circuitry 36 and illuminates indicator 38 comprising a light
23 emitting device. A typical backscatter reply signal is 20 ms in the
24 described embodiment. Such results in a visible flashing of indicator 38

1 in the described embodiment corresponding to received forward link
2 wireless signals 22.

3 Accordingly, the indication of operations of remote communication
4 device 14 using indicator 38 is responsive to processing of the forward
5 link wireless signal and generation of the return link wireless signal.
6 Other configurations for controlling indicator 38 are possible. Further,
7 the duration of the return link wireless signal can be adjusted in other
8 configurations to vary the length of the indicating signal using indication
9 circuitry 36.

10 Referring to Fig. 6, a graph illustrates an exemplary testing
11 operation using a remote communication device 14 having indication
12 circuitry 36 to determine communication range 11 of interrogator 12 in
13 one application. Time progresses from left to right in the graph
14 of Fig. 6. A voltage across resistor 52 of indication circuitry 36 is
15 represented in the vertical direction.

16 Remote communication device 14 can be moved throughout an
17 area adjacent wireless communication system 10. During such
18 movements, remote communication device 14 may be moved in and out
19 of communication range 11. Such results in the reception of only some
20 of the forward link wireless signals 22 being continually generated using
21 interrogator 12 during testing operations. Accordingly, the generation
22 of return link wireless signals 24 corresponds to received forward link
23 wireless signals 22 while remote communication device 14 is moved
24 within communication range 11.

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1 The generation of a return link wireless signal 24 results in
2 a spike 60. The divisions of the illustrated graph are
3 approximately 250 ms and individual spikes 60 are approximately 20 ms
4 in length corresponding to the duration of return link wireless
5 signals 24. The generation of the return link wireless signals 24
6 depends upon the movement of the remote communication device 14
7 with respect to communication range 11. Spikes 60 correspond to
8 remote communication device 14 being within communication range 11.
9 As illustrated, indicator 38 only generates some emissions responsive to
10 continuous generation of forward link wireless signals 22 from
11 interrogator 12 and responsive to remote communication device 14 being
12 moved in and out of communication range 11. Inasmuch as spikes 60
13 correspond to the emission of light from indicator 38, such can be
14 utilized by an individual to visually determine the boundaries of
15 communication range 11 of interrogator 12 in a given application. The
16 number of spikes 60 (i.e., outputted as flashes of light from
17 indicator 38 in the described configuration) increases with increasing
18 field strength.

19 Referring to Fig. 7, one spike 60 is illustrated in detail. Again,
20 time increases in the illustrated graph of Fig. 7 from left to right.
21 The voltage across resistor 52 of indication circuitry 36 is indicated in
22 the vertical direction. Some modulation upon the top portion of
23 spike 60 results due to backscatter modulation of the signal outputted
24 from pin 4 of communication circuitry 32. However, the capacitive

effect of the gate pin of transistor 50 minimizes such modulation effects upon the operation of indication circuitry 36.

Referring to Fig. 8, an alternative configuration of indication circuitry 36a of remote communication device 14 is illustrated. The depicted indication circuitry 36a is coupled with communication circuitry 32 and power source 34. Indication circuitry 36a can be utilized alone or in combination with indication circuitry 36 described with reference to Fig. 5 above.

Indication circuitry 36a is coupled with a data port 35 and a clock output 37 of communication circuitry. Port 35 and clock output 37 can respectively comprise pins 17, 18 of the integrated circuitry comprising communication circuitry 32. Port 35 can comprise a digital port and clock output 37 can comprise a digital clock output. The depicted indication circuitry 36a includes a latch 70, transistor 50, indicator 38, resistor 52 and capacitor 54.

Indication circuitry 36a provides benefits in numerous applications, such as inventory monitoring as an exemplary application. In particular, assuming there are a plurality of objects 16 which are being monitored, remote communication device 14 containing indication circuitry 36a can be utilized to identify one of more desired specific objects from the remaining objects within inventory.

For example, referring again to Fig. 2, a user can input a desired identifier within tag identifier 26 of forward link wireless signal 22. The identifier can correspond to a desired object 16 associated with the

remote communication device 14 identified by tag identifier 26. Tag identifier 26 can identify one or more desired remote communication devices 14 to identify one or more objects 16.

Interrogator 12 communicates the forward link wireless signal 22 having the proper identifier 26 within communication range 11. Remote communication devices 14 within communication range 11 receive the forward link wireless signal 22 including identifier 26. Individual remote communication devices 14 receiving forward link wireless signal 22 process the received forward link wireless signal 22. Individual remote communication devices 14 identified by the tag identifier 26 proceed to process command 27. Other remote communication devices 14 not identified by tag identifier 26 discard the received forward link wireless signal 22.

Command 27 within forward link wireless signal 22 can include a command to write to port 35 of communication circuitry 32. Following processing of command 27, communication circuitry 32 can generate and output a control signal to indication circuitry 36a. Indication circuitry 36a is configured to receive the control signal and to indicate presence of the respective remote communication device 14 responsive to the control signal.

In one configuration, communication circuitry 32 is configured to output a control signal to indication circuitry 36a comprising data 28 of a received forward link wireless signal 22. More specifically, command 27 can specify the writing of data 28 contained within

1 received forward link wireless signal 22 to port 35 of communication
2 circuitry 32. Data 28 can comprise a byte for controlling indication
3 circuitry 36a. For example, data 28 can include hex FF to turn on
4 indicator 38. Thereafter, interrogator 12 can communicate another
5 forward link wireless signal 22 including hex 00 within data 28. Writing
6 of the hex 00 to data port 35 can be utilized to turn off indicator 38.
7 Other data 28 can be supplied within a forward link wireless signal 22.
8 For example, hex AA can be utilized to flash indicator 38.

9 Data port 35 is coupled with a D-input of latch 70.
10 Communication circuitry 32 is configured to output a timing signal to
11 a clock (CLK) input of latch 70 via clock output 37. Latch 70 is
12 configured to receive the control signal including data 28 from
13 communication circuitry 32. Latch 70 is configured to store data 28
14 received from communication circuitry 32. Further, latch 70 is
15 configured to selectively assert an output signal via the Q-output
16 responsive to the received control signal in the described embodiment.
17 The Q-output is coupled with gate (G) electrode of transistor 50. The
18 source (S) electrode of transistor 50 is coupled with ground and the
19 drain (D) electrode of transistor 50 is coupled with indicator 38.

20 Indicator 38 is selectively coupled with latch 70 via transistor 50
21 and is configured to output a signal to indicate the presence of the
22 respective remote communication device 14 responsive to the control
23 signal (e.g., data 28) received within latch 70 from communication
24 circuitry 32. As described above, indicator 38 is preferably configured

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1 to emit a human perceptible signal to indicate the presence of the
2 respective remote communication device 14. In the depicted
3 embodiment, indicator 38 comprises a light emitting device such as a
4 light emitting diode (LED) configured to visually indicate the presence
5 of the respective remote communication device 14.

6 In accordance with the presently described embodiment, only the
7 remote communication devices 14 identified by identifier 26 of forward
8 link wireless signal 22 indicate the presence of the respective remote
9 communicate devices 14 using indication circuitry 36a. Accordingly, such
10 operates to identify desired objects from other objects according to one
11 application.

12 In compliance with the statute, the invention has been described
13 in language more or less specific as to structural and methodical
14 features. It is to be understood, however, that the invention is not
15 limited to the specific features shown and described, since the means
16 herein disclosed comprise preferred forms of putting the invention into
17 effect. The invention is, therefore, claimed in any of its forms or
18 modifications within the proper scope of the appended claims
19 appropriately interpreted in accordance with the doctrine of equivalents.
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